

# **LARGE WOODY MATERIAL RECRUITMENT POTENTIAL IN APTOS CREEK WATERSHED (INCLUDING VALENCIA CREEK)**

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## Large Woody Debris Recruitment Data Sheet

### Large Woody Material Recruitment Potential in Aptos Creek watershed (including Valencia Creek)

#### INTRODUCTION

Large woody material provides essential instream habitat for salmonids. Not only does the presence of large woody material<sup>1</sup> (LWM) create habitat such as pools but also provides refuge during winter storm events. Sediment storage is another benefit provided by LWM; log jams and other woody material can temporarily store sediment for decades thereby attenuating the sediment discharge over time. A large woody material recruitment survey was conducted during the 2002 fall as part of the Aptos Creek watershed assessment and enhancement plan process.

Throughout the Central California coast, most old growth redwood (*Sequoia sempervirens*) was harvested during the last 150 years and is no longer available for in-channel habitat. Old growth harvest has occurred throughout much of Coastal California, reducing both wood quantities and quality available to adjacent streams or rivers. “Second-growth redwood channels contain 2 to 5 times less wood than old-growth channels for a given cumulative percentage. A history of logging, log running, salvage, and stream cleaning has apparently created a deficit of wood in second-growth channels (Lisle unpubl.).”

Wood recruitment has been studied in a variety of forested watersheds in the Northwest. O’Connor and Ziemer (1989) found that the majority of coarse woody material in North Fork Caspar Creek (Mendocino County, California) was coniferous and entered the channel via bank erosion and windthrow. Large woody debris contributions are highly variable in both amounts and frequency but additions come primarily from individual trees and windthrow (Lienkamper and Swanson 1987). The majority of LWM will enter a system during a significant storm event therefore; the rate of recruitment can be highly variable.

Diameter and length of instream wood are significantly smaller in mature forests and hardwood forests than in old growth coniferous forests (McDade and others 1989). Steeper slopes will provide larger diameter yet shorter wood to the channel. Source distances, from the banks to the stream, are shorter in both mature coniferous and hardwood forests than in old growth forests, because tree lengths are shorter. Over 83% of hardwood pieces entered the channel from a distance of 10 m; 13% of coniferous pieces had a source distance of greater than 25 m (McDade and others 1989).

Certain tree species are considered more decay-resistant than others and therefore can provide longer lasting instream habitat. Redwoods are considered decay resistant, Douglas firs (*Pseudotsuga mensiezii*) are moderately resistant and most hardwoods commonly found within the riparian corridor are considered non-resistant (Harmon and Sexton 1996). Coupled with smaller diameters and shorter lengths, hardwoods generally do not provide much long term instream habitat.

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<sup>1</sup> The term “large woody material” or LWM is used in place of large woody debris to avoid any potential negative connotations with the term “debris”.

### Large Woody Debris Recruitment Data Sheet

Other LWM assessment/dynamics work is currently underway within the Santa Cruz Mountains and includes work within coho-bearing streams (Gazos, Waddell and Scott Creeks) (Leicester 2002) and within Soquel Creek (Lassettre 2001), which supports steelhead. This LWM Recruitment inventory was completed as a component of the Aptos Creek Watershed Assessment and Enhancement Plan to provide additional scientific data regarding salmonid habitat

### METHODS

The Coastal Watershed Council conducted LWM recruitment surveys using a modified California Department of Fish and Game (CDFG) protocol (Leicester 2002) to augment other assessment work. Swanson Hydrology and Geomorphology evaluated instream woody material in conjunction with fish habitat assessment work in 2001.

A total of 10.5 miles were surveyed on Aptos and Valencia Creeks during the 2002 fall. Surveys began at the mouth of Aptos Creek where it meets the Pacific Ocean. Aptos Creek was surveyed to the Bridge Creek confluence, approximately 5 miles from the Pacific Ocean. Valencia Creek was surveyed three miles upstream of Valencia Road, approximately 5.5 miles upstream from the confluence of Aptos Creek.

Reach designations were established during the fisheries habitat and geomorphic assessment and used for this study (see Salmonid Habitat and Limiting Factors Assessment, Hagar Environmental Science). Surveys were conducted every 1000-2000 feet, depending on the length of the reach (Table 1). Prior to fieldwork, a random number was selected between 1 and 1400 to establish the first survey point in Aptos Reach 1. The number of surveys per reach was determined based on the length of the reach. Survey points were a total of 200 feet in length and 150 feet in width to include both the left and right banks of the channel.

Distances were determined using a hip chain. It should be noted that hip chain string was removed from the channel to avoid negative impacts to wildlife movement and aesthetics. Although beginning and end points of each survey were flagged during the time of the survey, no flagging was left in the channel. A modified LWM Inventory form, based on the form developed by Flosi and others (1996), was utilized (Appendix A) that included the following categories:

- Perched live and dead trees (leaning over the creek)
- *Riparian 1* (deciduous-dominant riparian)
- *Riparian 2* (upslope riparian within 75 feet of bankfull)
- *Riparian 1* and *2* slopes (measured in percent)

The modified form was based on Leicester's work in Gazos Creek (2002) but was modified to record data outside of the bankfull area only. A data form, clinometer, hip chain and 200-foot tape measure were used to conduct the surveys.

## Large Woody Debris Recruitment Data Sheet

Table 1. LWM recruitment survey locations within Aptos watershed

Reach	Location description	Reach length (feet)	No. surveys completed	Distance between survey points (feet)
Aptos 1	Mouth of Aptos Creek to Spreckels Bridge	1,649	1	-NA-
Aptos 2	Spreckels Bridge to Nisene Marks State Parks (NMSP) kiosk	7,134	4	1,000
Aptos 3	Lower Nisene Marks State Park	8,340	4	1,000
Aptos 4	Nisene Marks State Park	10,366	5	2,000
Aptos 5	Nisene Marks State Park (including Bridge Creek confluence)	9,251	2	2,000
Valencia 1	Confluence of Aptos Creek to upstream of Valencia Middle School	5,599	5	1,000
Valencia 2	Aptos Junior High School to Valencia Rd Culvert	12,581	6	2,000
Valencia 3	Upper Valencia Creek	9,232	3	2,000

## RESULTS

**Aptos Creek**

In lower Aptos (**Reach A1**), the reach vegetation is predominately willow (*Salix* sp.), alder (*Alnus rubra*), and nonnative invasive pampas grass (*Cortaderia jubata*). This portion of the creek is considered lagoon habitat. No riparian vegetation is present within the lower lagoon; cement walls and riprap line the lagoon just upstream of the beach. From the cement-lined portion to the end of the reach at Spreckels Bridge, several homes line the right bank and Moosehead Road parallels the creek on the left bank. A total of 18 hardwoods and 5 live perched trees were observed within the survey section (Table 2). Riparian trees were generally small in size (1-2' diameter breast height).

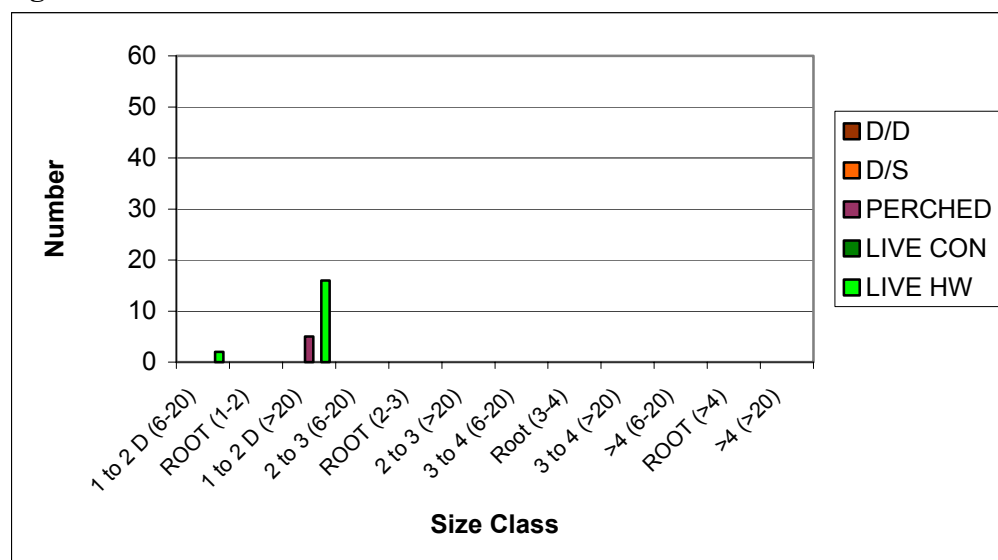
## Large Woody Debris Recruitment Data Sheet

Table 2. Reach Aptos 1 (one survey)

Size Class (DBH, feet)	Dead & Downed (Riparian 1)	Dead & Standing (Riparian 1)	Perched (Riparian 1)	Live Conifer (Riparian 1)	Live Hardwood (Riparian 1)
1 to 2 D (6-20)					2
ROOT (1-2)					
1 to 2 D (>20)			5		16
2 to 3 (6-20)					
ROOT (2-3)					
2 to 3 (>20)					
3 to 4 (6-20)					
Root (3-4)					
3 to 4 (>20)					
>4 (6-20)					
ROOT (>4)					
>4 (>20)					

Reach A1 provides little to no recruitment opportunities for Aptos Creek due to the lack of riparian vegetation and the fact that this reach is at the mouth of the creek where a) flows and tidal influence may move wood out to the ocean quickly and b) human influences, due to an urbanized environment, may equate to frequent wood removal.

Figure 1. Reach A1



**Reach A2** is fairly heterogeneous, exhibiting a variety of riparian habitat from Spreckels Bridge to the lower boundary of Nisene Marks State Park. This reach encompasses many residential homes within the riparian zone, some commercial parcels within the Aptos Village area, and the Aptos Village Community Park. The dominant riparian vegetation includes red alder, cottonwood (*Populus balsamifera tricarpa*), redwood (*Sequoia sempervirens*), tanoak (*Lithocarpus densiflora*), and also Monterey Pine and willow. Management of riparian vegetation has occurred where homes are present within the riparian zone.

### Large Woody Debris Recruitment Data Sheet

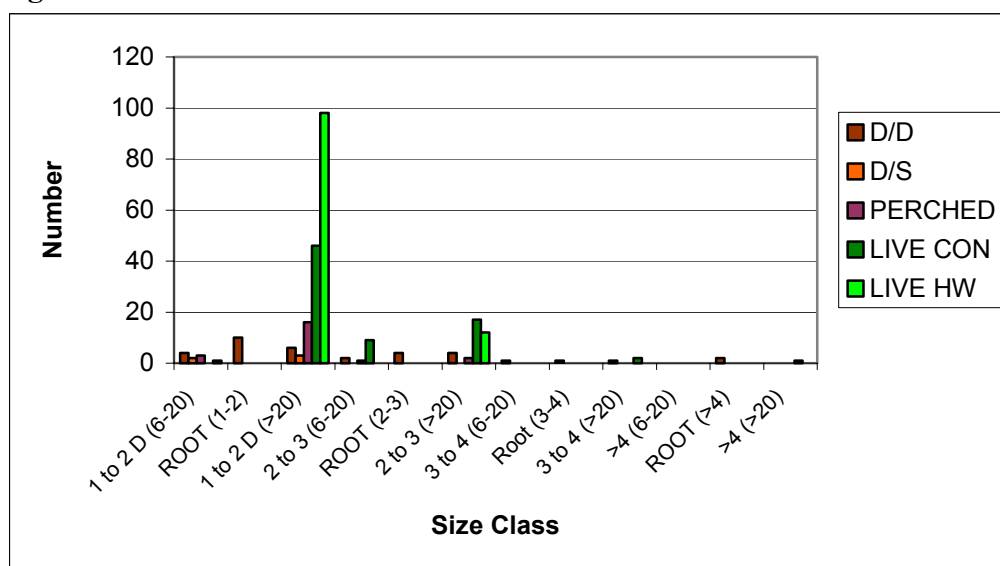
Within the four survey points, a total of 111 hardwoods and 75 redwoods were tallied indicative of a lower coastal watershed assemblage (Table 3). Dead and downed trees were observed ranging in diameter from one foot to roots in excess of 4 feet, with the majority of wood falling in the 1-3-foot diameter range. A total of 22 perched trees and 5 snags (dead and standing) were also observed.

**Table 3. Reach Aptos 2 (four surveys)**

Size Class (DBH, feet)	Dead & Downed		Dead & Standing		Perched		Live Conifer		Live Hardwood	
	Riparian 1	Riparian 2	Riparian 1	Riparian 2	Riparian 1	Riparian 2	Riparian 1	Riparian 2	Riparian 1	Riparian 2
1 to 2 D (6-20)	4	0	2	0	3				1	0
ROOT (1-2)	5	5								
1 to 2 D (>20)	6	0	3	0	8	7	13	36	92	6
2 to 3 (6-20)	2	0	1	0	1	0	0	1		
ROOT (2-3)	2	2								
2 to 3 (>20)	4	0			1	1	4	13	4	8
3 to 4 (6-20)	1	0								
Root (3-4)	1	0								
3 to 4 (>20)	0	1						2		
>4 (6-20)										
ROOT (>4)	2	0								
>4 (>20)							1	0		

The majority of wood potentially available to the reach is relatively small (1-2' DBH) and most wood within riparian 1 is hardwood. While quantities of wood entering the channel may be relatively high, the likelihood that the wood will actually stay in the system over time is low. Virtually no large wood (>3' DBH) was tallied within any of the survey points.

**Figure 2. Reach A2**



**Reach A3** extends from the lower boundary of Nisene Marks State Park up into the state park where recreational use (hiking, jogging and mountain biking) is heavy. The primary riparian

### Large Woody Debris Recruitment Data Sheet

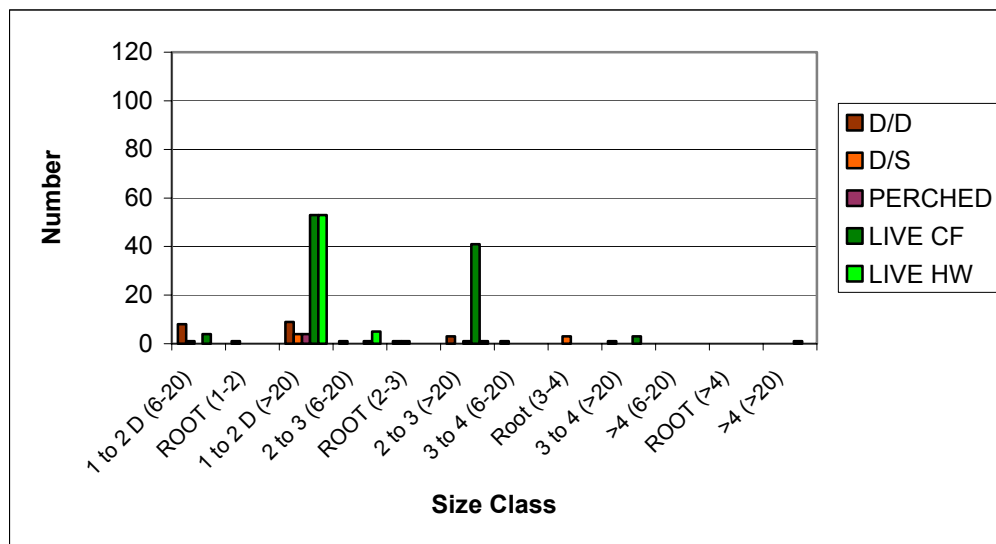
trees observed within the four steep sloped survey points included alder, redwood, hazelnut (*Corylus cornuta*), tanoak, Douglas fir (*Pseudotsuga menziesii*), and big leaf maple (*Acer macrophyllum*). The riparian zone contains a mix of both coniferous and hardwood trees but larger (2-3' DBH) redwoods and Douglas firs are dominant. Downed trees, snags and few perched trees were also present.

**Table 4. Reach Aptos 3 (four surveys)**

Size Class (DBH, feet)	Dead & Downed		Dead & Standing		Perched		Live Conifer		Live Hardwood	
	Riparian 1	Riparian 2	Riparian 1	Riparian 2	Riparian 1	Riparian 2	Riparian 1	Riparian 2	Riparian 1	Riparian 2
1 to 2 D (6-20)	7	1	1					4	1	
ROOT (1-2)	1									
1 to 2 D (>20)	5	4	3	1	4		19	34	30	23
2 to 3 (6-20)	1						1			
ROOT (2-3)			2							
2 to 3 (>20)	3				1		9	32	1	5
3 to 4 (6-20)	1									
Root (3-4)			3							
3 to 4 (>20)	1							3		
>4 (6-20)										
ROOT (>4)										
>4 (>20)								1		

By comparison, survey points within this reach contained a higher number of larger coniferous trees (2-3' DBH), but the majority of these are located within riparian 2, not directly adjacent to the channel.

**Figure 3. Reach A3**



**Reach A4** spans a little more than a mile within Nisene Marks State Park and contains redwood, tanoak, alder and big leaf maple as the primary riparian trees. A total of 5 survey points were evaluated within this reach (Table 5). Both younger (1-2' DBH) and large second-growth redwoods (2-4' DBH) were the main trees observed in the survey points. Many perched trees



### Large Woody Debris Recruitment Data Sheet

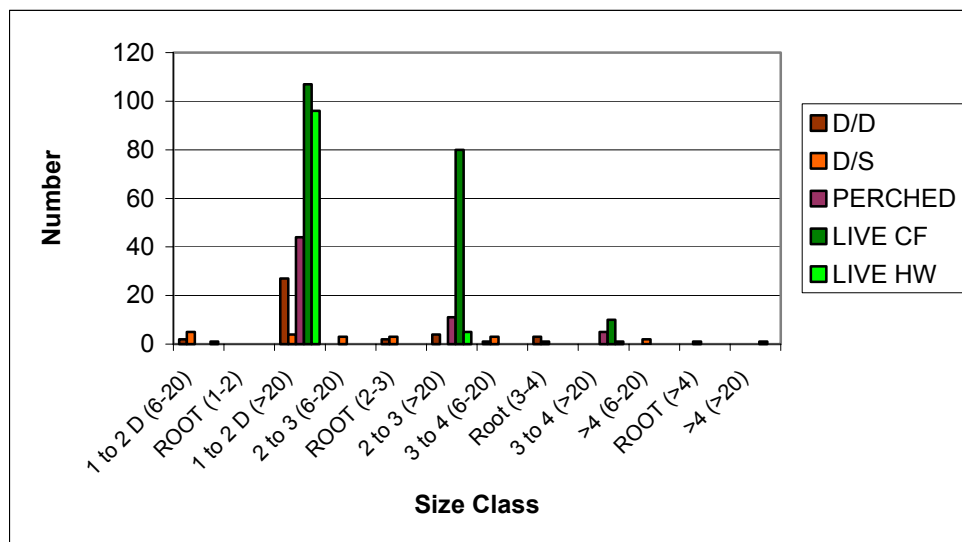
were also observed ranging from 1-4' DBH. A large proportion of dead and downed trees were observed (27 1-2' DBH) and 22 snags of variable size were also noted.

**Table 5. Reach Aptos 4 (five surveys)**

Size Class (DBH, feet)	Dead & Downed		Dead & Standing		Perched		Live Conifer		Live Hardwood	
	Riparian 1	Riparian 2	Riparian 1	Riparian 2	Riparian 1	Riparian 2	Riparian 1	Riparian 2	Riparian 1	Riparian 2
1 to 2 D (6-20)	1	1	2	3						1
ROOT (1-2)										
1 to 2 D (>20)	14	13	4		13	31	8	100	16	76
2 to 3 (6-20)			1	2						
ROOT (2-3)	2		3							
2 to 3 (>20)	3	1		1		11	10	70		5
3 to 4 (6-20)	1	3								
Root (3-4)	3		1							
3 to 4 (>20)						5	1	9		1
>4 (6-20)				2						
ROOT (>4)			1							
>4 (>20)								1		

A much higher number of larger coniferous trees (2-4' DBH) trees were present within riparian 1 and riparian 2. Also of note, there are many perched trees available to the channel. Both of these are indicative of steeper slopes. Opportunities for large woody material to enter the channel are high in this reach.

**Figure 4. Reach A4**



Two surveys were completed in **Reach A5**; the remaining two surveys were not completed due to the advent of winter storms. This reach encompasses the Bridge Creek confluence and contains redwood, tanoak, and big leaf maple, typical of upper coastal watersheds. Mature second growth and old growth redwood trees were observed within the reach with a relatively even distribution of size ranges from 1-2', 2-3' and 3-4' DBH (Table 6). Down trees, ranging in all diameters, dead and standing and many perched trees were also observed.

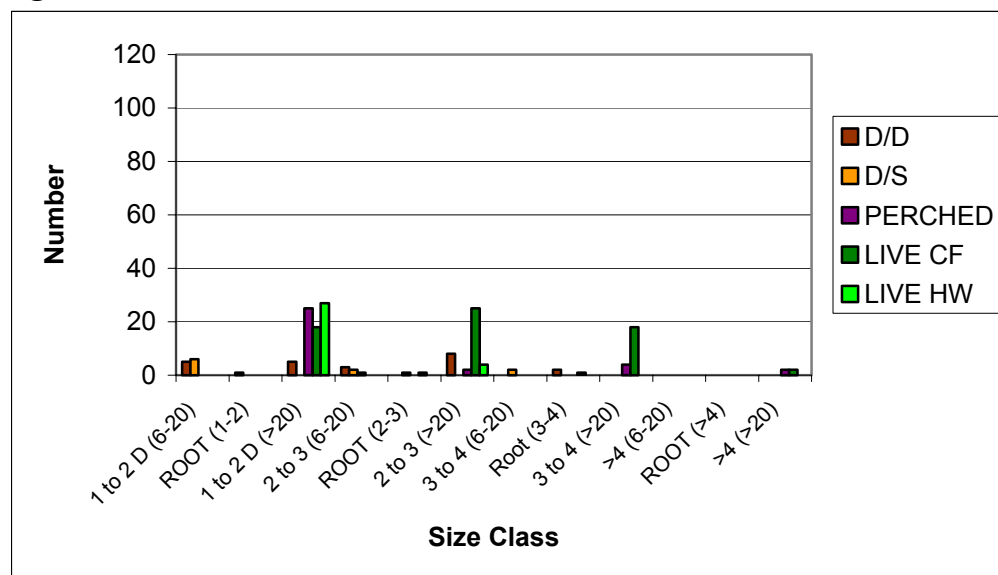
## Large Woody Debris Recruitment Data Sheet

Table 6. Reach Aptos 5 (two surveys)

Size Class (DBH, feet)	Dead & Downed		Dead & Standing		Perched		Live Conifer		Live Hardwood	
	Riparian 1	Riparian 2	Riparian 1	Riparian 2	Riparian 1	Riparian 2	Riparian 1	Riparian 2	Riparian 1	Riparian 2
1 to 2 D (6-20)		3		1						
ROOT (1-2)		3		1						
1 to 2 D (>20)		5				25		18		27
2 to 3 (6-20)		3		2		1				
ROOT (2-3)				1						
2 to 3 (>20)		8				2		25		4
3 to 4 (6-20)				2						
Root (3-4)		2								
3 to 4 (>20)						4		18		
>4 (6-20)										
ROOT (>4)										
>4 (>20)						2		2		

Similar to Reach 4, Reach 5 exhibits a high degree of larger wood available for instream habitat. Opportunities for large woody material to enter the channel are high in this reach as well.

Figure 5. Reach A5

Valencia Creek

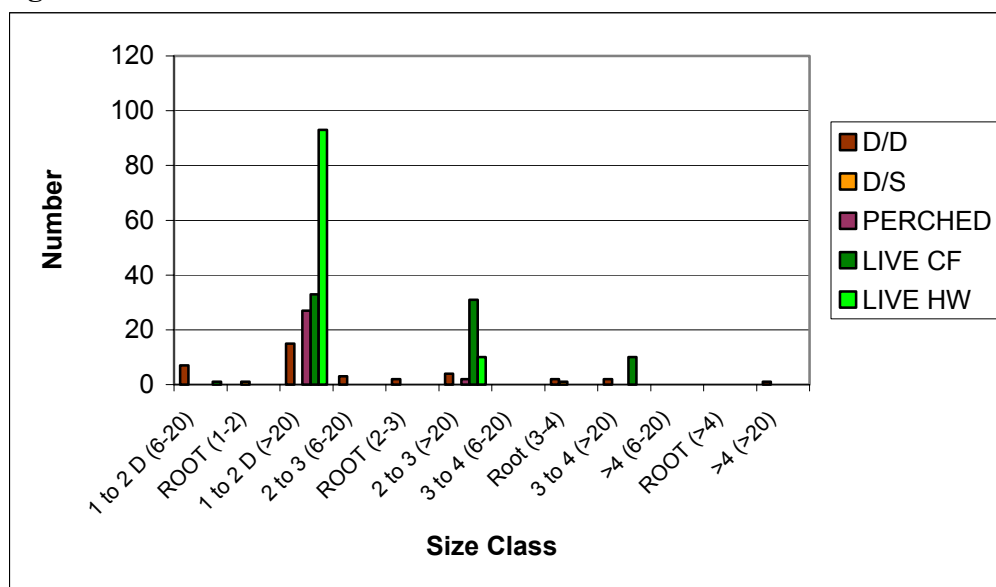
**Reach V1**, in lower Valencia, extends one half mile from the confluence with Aptos Creek throughout the portion that follows an east – west trend. Typical of lower drainage riparian, the dominant trees are alder, box elder (*Acer negundo californicum*), redwood, tanoak, big leaf maple and coast live oak (*Quercus agrifolia*). Hardwoods dominated the riparian zone, with the majority of live trees in the 1-2' DBH size class. It should be noted that several mature redwoods (2-4' DBH) were also present throughout the five survey locations. Few snags (2) were present yet, a multitude of small (1-2' DBH) perched and downed wood was documented in the reach.

## Large Woody Debris Recruitment Data Sheet

Table 7. Reach Valencia 1 (five surveys)

Size Class (DBH, feet)	Dead & Downed		Dead & Standing		Perched		Live Conifer		Live Hardwood	
	Riparian 1	Riparian 2	Riparian 1	Riparian 2	Riparian 1	Riparian 2	Riparian 1	Riparian 2	Riparian 1	Riparian 2
1 to 2 D (6-20)	7								1	
ROOT (1-2)			1							
1 to 2 D (>20)	14				26		21	12	90	9
2 to 3 (6-20)	4									
ROOT (2-3)	2									
2 to 3 (>20)	4				2		25	6	11	
3 to 4 (6-20)										
Root (3-4)	2		1							
3 to 4 (>20)	2						5	5		
>4 (6-20)										
ROOT (>4)										
>4 (>20)	1									

Figure 6. Reach V1



The majority of wood available within this reach is smaller hardwoods but there are also larger redwoods (2-4' DBH) available for recruitment. Opportunities for recruitment within this reach are relatively low due to the large amount of residential and commercial parcels adjacent to the channel due to the following factors: active management of instream wood is highly likely; the riparian canopy contains primarily smaller diameter hardwood trees; and the riparian corridor is reduced in some areas due to development. The smaller diameter hardwoods typically provide only short term in channel habitat because they are washed downstream more easily and are more susceptible to decay.

Transecting a diverse area of dense residential and commercial parcels as well as rural residential and orchard lands, **Reach V2** extends to Valencia Road culvert. A total of six surveys were completed within this reach. Dominant trees included redwood, tanoak, alder, box elder, dogwood (*Cornus sericea*), and willow. A mixture of coniferous and hardwood trees were

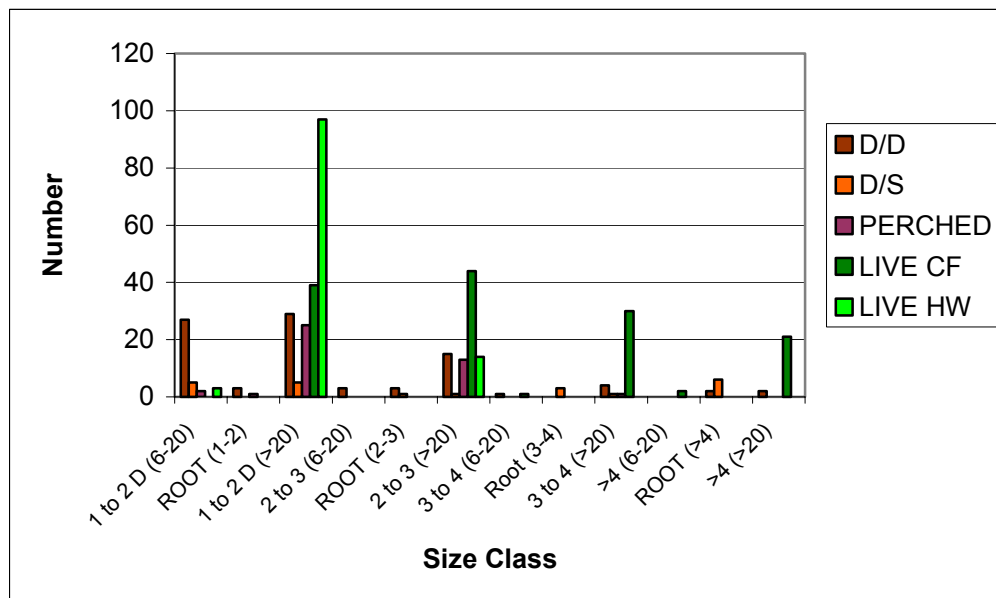
### Large Woody Debris Recruitment Data Sheet

present with mature redwoods ranging from 2- >4' DBH dominating the survey points. Large numbers of downed wood, snags and perched trees were also observed in the six survey points.

**Table 8. Reach Valencia 2 (six surveys)**

Size Class (DBH, feet)	Dead & Downed		Dead & Standing		Perched		Live Conifer		Live Hardwood	
	Riparian 1	Riparian 2	Riparian 1	Riparian 2	Riparian 1	Riparian 2	Riparian 1	Riparian 2	Riparian 1	Riparian 2
1 to 2 D (6-20)	16	11	3	2	2				3	
ROOT (1-2)	3				1					
1 to 2 D (>20)	12	17	3	1	18	7	8	36	43	54
2 to 3 (6-20)	3									
ROOT (2-3)	3		1							
2 to 3 (>20)	7	8		1	6	7	4	40	4	8
3 to 4 (6-20)		1					1			
Root (3-4)			3							
3 to 4 (>20)	1	3	1			1	4	26		
>4 (6-20)								4		
ROOT (>4)	2		5							
>4 (>20)	2		1				3	18		

**Figure 7. Reach V2**



Valencia 2 data indicate diversity in both size and type of wood present in the riparian zone. In addition to 1-2' DBH hardwoods and conifers, some residual old growth redwoods are present and many mature redwoods (3-4' DBH) were recorded during the survey. Opportunities for large woody material to enter the channel are high in this reach, although, similar to Valencia 1, the probability that instream LWM will be managed by adjacent landowners is high. Additionally, the high proportion of small diameter hardwoods limits the benefit and opportunity for longterm retention of wood in the channel.

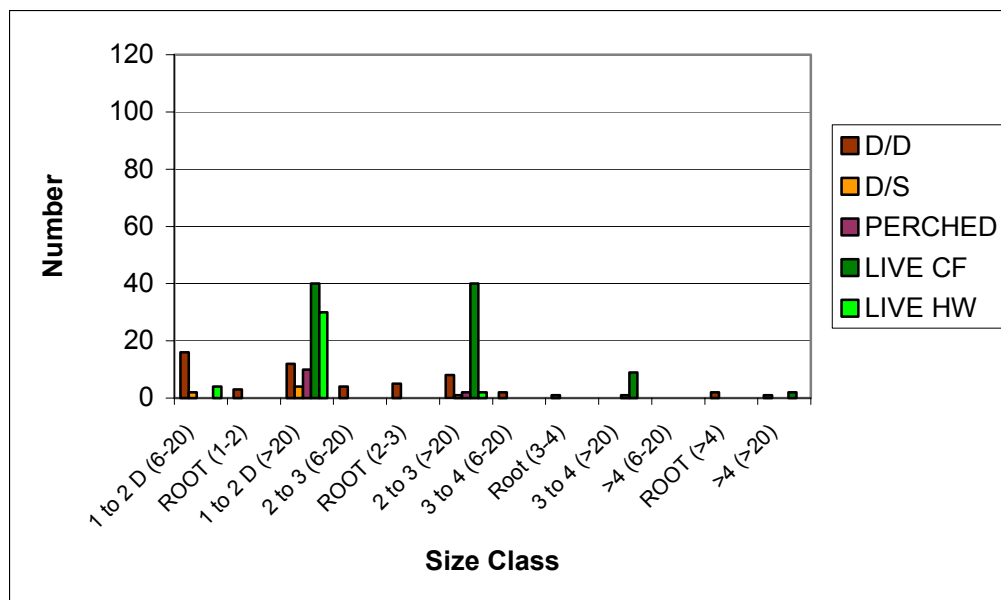
### Large Woody Debris Recruitment Data Sheet

Three out of five surveys were conducted within **Reach V3**, which extends to the headwaters of Valencia Creek from the Valencia Creek culvert. Primary tree types included redwood, alder, tanoak, big leaf maple, and coast live oak. Mature conifers (1-4' DBH) were the dominant trees within the riparian zone, with smaller hardwoods (1-2' DBH) also present. Downed wood was ample with few snags and primarily small diameter perched wood. This reach contains a large number of mature conifers (3-4' DBH) but less old growth trees compared to Valencia 2.

**Table 9. Reach Valencia 3 (three surveys)**

Size Class (DBH, feet)	Dead & Downed		Dead & Standing		Perched		Live Conifer		Live Hardwood	
	Riparian 1	Riparian 2	Riparian 1	Riparian 2	Riparian 1	Riparian 2	Riparian 1	Riparian 2	Riparian 1	Riparian 2
1 to 2 D (6-20)	8	3						1		5
ROOT (1-2)	3									
1 to 2 D (>20)	8	4	3	1	4	6	2	37	20	6
2 to 3 (6-20)	1	3								
ROOT (2-3)	4	1								
2 to 3 (>20)	4	4	1			2	4	36	1	1
3 to 4 (6-20)	1	1								
Root (3-4)		1								
3 to 4 (>20)						1		9		
>4 (6-20)										
ROOT (>4)	1	1								
>4 (>20)		1						2		

**Figure 8. Reach V3**



### CONCLUSIONS

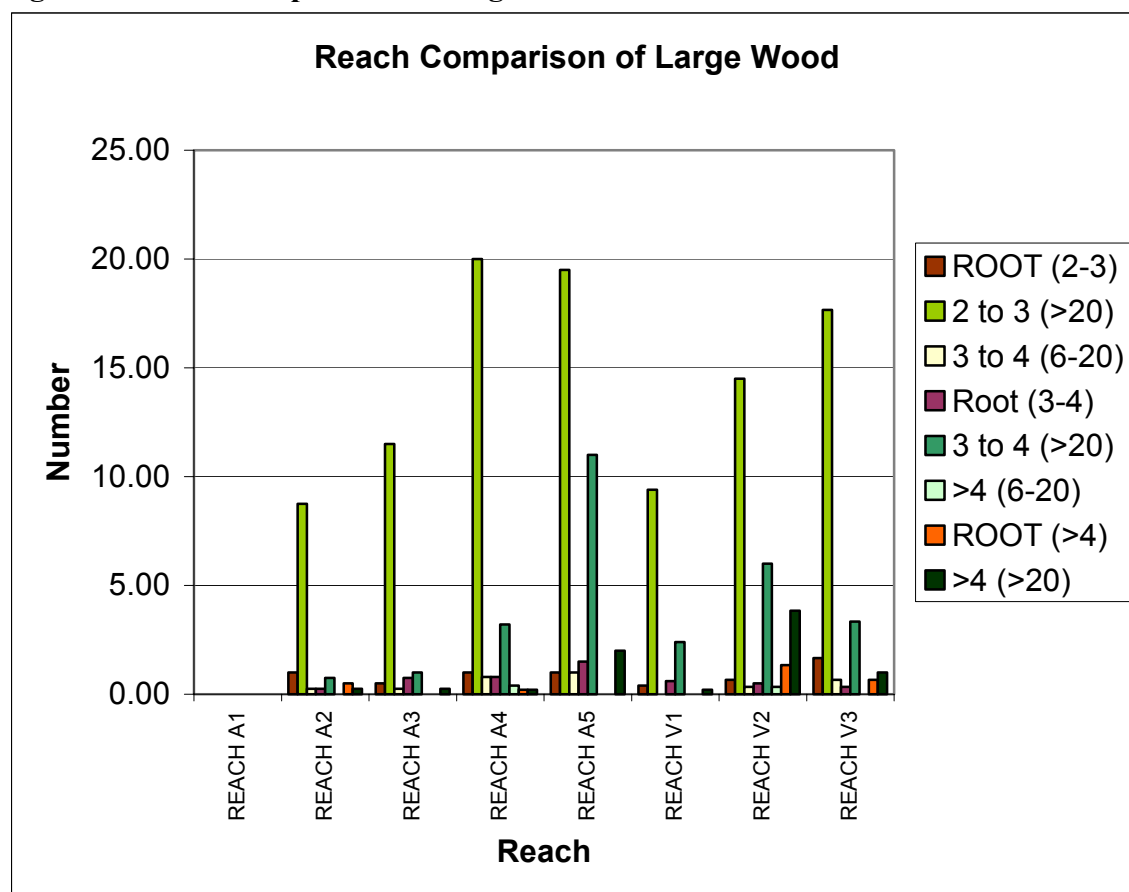
The majority of Aptos watershed surveyed contains very little old growth. However, upper Aptos Creek and Valencia Creek (especially reaches A5 and V2) support mature coniferous trees that have a high likelihood of entering the channel due to tree size and steep slopes.

## Large Woody Debris Recruitment Data Sheet

Aptos reaches 4 and 5 and Valencia reaches 2 and 3 contained the highest proportion of mature-old growth coniferous trees (>2' DBH), in both riparian sections one and two. These areas are important for recruitment of LWM that has a likelihood of remaining in the channel and providing long-term benefits for salmonid habitat and sediment storage. If larger diameter (>3' DBH) wood that spans the channel is left in place once it enters the stream, wood can act as “catcher” logs, creating more complex habitat. Comparisons were made between reaches by averaging the number of pieces of wood by number of surveys per reach. Figure 9 exhibits the lack of old growth wood in all reaches. Overall, Reaches A5 and V2 have the highest numbers of large wood, compared to other reaches surveyed. Reaches A5, V2 and V3 have the largest amounts of large wood (>4 feet diameter, > 20 feet length).

The lack of old growth wood within most of the Santa Cruz Mountains, including Aptos watershed, signifies increased importance in preserving instream wood and allowing natural LWM recruitment to occur for salmonid habitat and to attenuate sediment transport throughout Aptos and Valencia creeks.

**Figure 9. Reach Comparison of Large Wood**



## Large Woody Debris Recruitment Data Sheet

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## Large Woody Debris Recruitment Data Sheet

STREAM: \_\_\_\_\_ SAMPLE \_\_\_\_\_ of \_\_\_\_\_ REACH NO. \_\_\_\_\_

DATE: \_\_\_\_\_ DRAINAGE: \_\_\_\_\_ USGS QUAD: \_\_\_\_\_

REFERENCE POINT: \_\_\_\_\_ SAMPLE LENGTH: \_\_\_\_\_

REACH LOCATION (Feet from Ref. Pt.): \_\_\_\_\_ START: \_\_\_\_\_ STOP: \_\_\_\_\_ TOTAL: \_\_\_\_\_

LAT.: \_\_\_\_\_ LONG.: \_\_\_\_\_ (Reach Start of Ref. Pt.) T: \_\_\_\_\_ R: \_\_\_\_\_ S: \_\_\_\_\_

GPS used? (y n)

SURVEYORS: \_\_\_\_\_

CHANNEL CHARACTERISTICS \_\_\_\_\_

RIGHT BANK					LEFT BANK				
% SLOPE: DOM. VEG.:					% SLOPE: DOM. VEG.:				
	D/D	D/S	Per	LIVE C    D		D/D	D/S	Per	LIVE C    D
1 to 2 D 6 to 20					1 to 2 D 6 to 20				
Root					Root				
1 to 2 D >20'					1 to 2 D >20'				
2 to 3 D 6 to 20					2 to 3 D 6 to 20				
Root					Root				
2 to 3 D >20'					2 to 3 D >20'				
3 to 4 D 6 to 20					3 to 4 D 6 to 20				
Root					Root				
3 to 4 D >20'					3 to 4 D >20'				
>4 D 6 to 20					>4 D 6 to 20				
Root					Root				
>4 D >20'					>4 D >20'				

### NOTES:

Other aspects to include:

species, aspect, slope, erosion, unstable slope, height of tree, channel width/channel type

RIP 1= Area at beginning of BF channel, of variable recorded width but dominated by deciduous riparian trees

RIP 2= Upslope; any area beyond the riparian zone but still falling w/in 75 ft of BF